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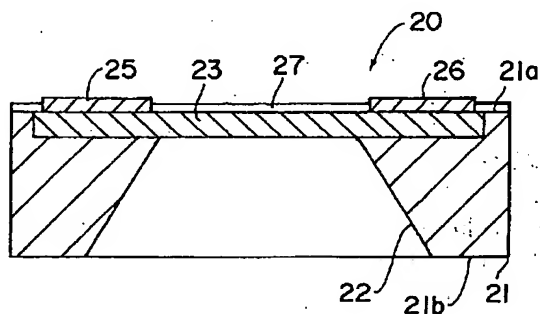
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(54) 【発明の名称】 赤外線放射素子

(57) 【要約】

【課題】 機械的な強度と電気的な特性や放射特性とを両立させる。

【解決手段】  $n^-$  型シリコンからなる素子基板21には穴22が貫通するように設けられ、穴22の一方の開口面を塞ぐようにp型半導体からなる帯状の隔膜部23が形成されている。隔膜部23の両端表面には、金属材料からなる第1、第2の電極25、26が設けられており、この第1、第2の電極25、26に電圧を印加すると、隔膜部23に電気が流れて隔膜部23が発熱し、赤外線を放射する。また、素子基板21の一面21a側および隔膜部23の表面は、赤外線の放射を促進するためのシリコン酸化膜27によって覆われている。



## 【特許請求の範囲】

【請求項1】一面側から反対面に貫通する穴を有する素子基板と、

前記素子基板の一面側で前記穴の一方の開口面を塞ぐように形成され、通電を受けて赤外線を放射するp型半導体からなる隔膜部と、

前記隔膜部の両端に設けられた第1、第2の電極と、  
前記隔膜部の少なくとも一面を覆うように形成された赤外線放射促進膜とを備えた赤外線放射素子。

【請求項2】前記赤外線放射促進膜は、前記隔膜部の両面を覆うように形成され、

前記素子基板の反対面側には、前記穴の他方の開口面を塞ぎ前記隔膜部から放射された赤外線を該隔膜部側へ反射する反射部が設けられていることを特徴とする請求項1記載の赤外線放射素子。

【請求項3】前記素子基板には、前記穴と前記隔膜部とが複数組設けられ、該複数の隔膜部が電気的に接続されていることを特徴とする請求項1または請求項2記載の赤外線放射素子。

【請求項4】一面側から反対面に貫通する穴を有する素子基板と、

前記素子基板の一面側で前記穴の一方の開口面を塞ぐように形成されたp型半導体からなる隔膜部と、  
前記隔膜部の少なくとも一面側に設けられ通電を受けて赤外線を放射するn型半導体からなる発熱部と、  
前記発熱部の両端に設けられた第1、第2の電極と、  
前記発熱部の表面を覆うように形成された赤外線放射促進膜とを備えた赤外線放射素子。

【請求項5】前記隔膜部に第3の電極を設けたことを特徴とする請求項4記載の赤外線放射素子。

【請求項6】前記発熱部は、中央部の幅が両端部の幅より大となるように形成されていることを特徴とする請求項4または請求項5記載の赤外線放射素子。

【請求項7】前記素子基板には、前記穴と隔膜部と発熱部とが複数組設けられ、該複数の発熱部が電気的に接続されていることを特徴とする請求項4または請求項5または請求項6記載の赤外線放射素子。

## 【発明の詳細な説明】

【0001】

【発明の属する技術分野】本発明は、シリコン等の素子基板に形成した隔膜部から赤外線を放射するダイヤフラム構造の赤外線放射素子に関する。

【0002】

【従来の技術】赤外線放射素子は、発光素子としての利用の他に、赤外線の吸収を利用したガス分析機器の光源としても利用されている。

【0003】この赤外線式ガス分析のために従来から用いられていた赤外線光源は、セラミックにヒータを埋め込んだものや、白金やタングステンのフィラメントをガラス管に封入したものであったが、いずれの構造のもの

も経時変化が大きいという問題があり、また、熱容量が大きいために間欠的に赤外線を放射させる（チョッピング）場合に、高速な機械的なチョッパーが必要であった。

【0004】この問題を解決するために、マイクロマシニング技術を用いてシリコン等の素子基板の一面に半導体からなる橋梁部を設け、この橋梁部に通電をして赤外線を放射する、いわゆるマイクロブリッジ構造の赤外線放射素子が種々提案されている。

【0005】このマイクロブリッジ構造の赤外線放射素子としては、図23、図24に示す構造のものが知られている。

【0006】この赤外線放射素子10は、マイクロマシニング技術によって、シリコンの素子基板11の一面11a側にp型半導体からなる橋梁部12を設け、橋梁部12の両端に第1、第2の電極14、15を設け、素子基板11の一面中央に陥没部16を設けて橋梁部12の下面側と素子基板との間に熱分離空間17を形成している。なお、電極14、15の表面を除く部分は保護用の薄膜18で覆われている。

【0007】この赤外線放射素子10では、電極14、15間に電圧を印加するとp型半導体からなる橋梁部12に電気が流れて橋梁部12が発熱し、赤外線が放射される。

【0008】このようなマイクロブリッジ構造の赤外線放射素子は、素子形状が小さく熱容量が小さいため、高速なチョッピングができるという利点がある。

【0009】

【発明が解決しようとする課題】しかしながら、前記したマイクロブリッジ構造の赤外線放射素子10で、橋梁構造を堅固にするために橋梁部12の幅や厚みを大きくすると、橋梁部自体の抵抗値が小さくなり、駆動電流が過大になってしまい、使いづらいという問題がある。

【0010】また、駆動電流を適正な値にするために、橋梁部12の幅や厚みを小さくすると、橋梁部の機械的な強度が著しく低下し、外力や電流のオンオフによる急激な形状変化によってもたらされる疲労によって破壊されてしまう。また、橋梁部の面積が小さくなるので赤外線の放射量も低下してしまう。

【0011】本発明は、これらの問題を解決し、機械的な強度と電気的な特性や放射特性とを両立させた赤外線放射素子を提供することを目的としている。

【0012】

【課題を解決するための手段】前記目的を達成するために、本発明の請求項1の赤外線放射素子は、一面側から反対面に貫通する穴を有する素子基板と、前記素子基板の一面側で前記穴の一方の開口面を塞ぐように形成され、通電を受けて赤外線を放射するp型半導体からなる隔膜部と、前記隔膜部の両端に設けられた第1、第2の電極と、前記隔膜部の少なくとも一面を覆うように形成

された赤外線放射促進膜とを備えている。

【0013】また、本発明の請求項2の赤外線放射素子は、請求項1の赤外線放射素子において、前記赤外線放射促進膜は、前記隔膜部の両面を覆うように形成され、前記素子基板の反対面側には、前記穴の他方の開口面を塞ぎ前記隔膜部から放射された赤外線を該隔膜部側へ反射する反射部が設けられている。

【0014】また、本発明の請求項3の赤外線放射素子は、請求項1または請求項2の赤外線放射素子において、前記素子基板には、前記穴と前記隔膜部とが複数組設けられ、該複数の隔膜部が電気的に接続されている。

【0015】また、本発明の請求項4の赤外線放射素子は、一面側から反対面に貫通する穴を有する素子基板と、前記素子基板の一面側で前記穴の一方の開口面を塞ぐように形成されたp型半導体からなる隔膜部と、前記隔膜部の少なくとも一面側に設けられ通電を受けて赤外線を放射するn型半導体からなる発熱部と、前記発熱部の両端に設けられた第1、第2の電極と、前記発熱部の表面を覆うように形成された赤外線放射促進膜とを備えている。

【0016】また、本発明の請求項5の赤外線放射素子は、請求項4の赤外線放射素子において、前記隔膜部に第3の電極を設けている。

【0017】また、本発明の請求項6の赤外線放射素子は、請求項4または請求項5の赤外線放射素子において、前記発熱部は、中央部の幅が両端部の幅より大となるように形成されている。

【0018】また、本発明の請求項7の赤外線放射素子は、請求項4または請求項5または請求項6の赤外線放射素子において、前記素子基板には、前記穴と隔膜部と発熱部とが複数組設けられ、該複数の発熱部が電気的に接続されている。

【0019】

【発明の実施の形態】以下、図面に基づいて本発明の実施形態を説明する。なお、以下の各実施形態の説明において、同一構成要素には同一符号を付して説明を省略する。

【0020】(第1の実施の形態)図1、図2は、本発明の第1の実施形態の赤外線放射素子20を示している。この赤外線放射素子20の素子基板21は、n<sup>-</sup>型シリコンからなり、その一面21a側から反対面21b側に台形状に貫通する穴22が設けられている。

【0021】素子基板21の一面側21aにはp型半導体からなる帯状の隔膜部23が穴22の一方の開口面を塞ぐように形成されている。隔膜部23の両端表面には、金属材料からなる第1、第2の電極25、26が設けられており、この第1、第2の電極25、26に電圧を印加すると、隔膜部23に電気が流れて隔膜部23が発熱し、赤外線を放射する。

【0022】また、素子基板21の一面21a側および

隔膜部23の表面は、図2に示しているように、表面保護の目的だけでなく、赤外線の放射を促進するためのシリコン酸化膜27によって覆われており、この膜27によって隔膜部23からの赤外線の放射が促進される。

【0023】即ち、素子表面の保護の目的だけの場合酸化膜の厚さは一般的に0.1 $\mu$ m程度で十分であるが、図3に示すように、シリコン酸化膜の厚さを一定値(ほぼ1 $\mu$ m)以上にすると赤外線の放射率が格段に高くなることが判明したので、この実施形態の赤外線放射素子20では、少なくとも隔膜部23の表面のシリコン酸化膜27の厚さを0.4 $\mu$ m以上(例えば1 $\mu$ m程度)に設定している。

【0024】このようにいわゆるダイヤフラム構造の隔膜部に電極を設けた赤外線放射素子20では、マイクロブリッジ構造の赤外線放射素子に比べて構造自体が堅固であるため、薄い隔膜部でもその面積を大きくすることができ、赤外線の放射パワー密度を大幅に増大させることができる。また、隔膜部23の熱がダイヤフラム構造を介して適度に放熱されるため、チョッピング周波数を低下させずに済み、高速に変調することもできる。

【0025】この赤外線放射素子20は、マイクロマシンング技術によって容易に製造することができる。以下、その製造方法を簡単に説明する。

【0026】まず、比抵抗8~15 $\Omega\cdot\text{cm}$ の面方位(100)のn<sup>-</sup>型単結晶半導体を素子基板として用意し、その素子基板の一面に熱酸化処理を施すことによって0.7 $\mu$ m程度の厚さの熱酸化膜を形成し、p型半導体層を形成する領域の熱酸化膜を写真蝕刻技術によって除去する。

【0027】次に、素子基板の一面に対してイオン注入法を用いて、高濃度、例えばドーズ量として $4.0\times 10^{16}$ イオン/ $\text{cm}^2$ のボロンを加速電圧17.5kVで打ち込み、1100 $^{\circ}\text{C}$ ~1200 $^{\circ}\text{C}$ の高温の窒素ガス雰囲気中で10分から60分程度のアニーリングを施して、前記酸化膜が除去された領域に所望の厚さ(例えば5 $\mu$ m)のp型半導体層を隔膜部23として形成してから、素子基板の表面の熱酸化膜を除去する。

【0028】次に、素子基板の一面に熱酸化処理によって0.4 $\mu$ m~1 $\mu$ m程度の厚さで熱酸化膜(この酸化膜は、素子表面の保護と赤外線の放射促進用である)を形成し、隔膜部23の両端の電極形成領域の熱酸化膜を写真蝕刻技術によって除去し、素子基板の一面全体に金、アルミニウム等の薄膜を真空蒸着法によって形成した後、パターニングによって電極形成領域以外の薄膜を除去して、第1、第2の電極25、26を形成する。

【0029】最後に、アンモニア溶液等の異方性エッチング特性と、エッチング速度のキャリア濃度依存性を利用して隔膜部23の下面側から素子基板の反対面側へ貫通する穴22を形成する。

【0030】このようにして作成された赤外線放射素子

はダイサーでチップ単位に分割され、TO5型等のパッケージにマウントされ、パッケージの端子と赤外線放射素子の第1、第2の電極25、26の間が配線される。なお、このマウントの際パッケージ内は用途に応じて不活性ガスの雰囲気気密される。また、パッケージの赤外線放射用の窓は硝子、サファイヤ、フッ化カルシウム等が用いられる。

【0031】このように赤外線放射素子がパッケージ内にマウントされた赤外線放射器では、端子間に電圧を印加することによって、内部の赤外線放射素子の発熱部に電気が流れて赤外線が放射され、この赤外線が窓から出力される。

【0032】(第2の実施の形態)図4、図5は、本発明の第2の実施形態の赤外線放射素子30を示している。この赤外線放射素子30は、隔膜部23の下面側にも0.4~1.0 $\mu$ m程度の厚さのシリコン酸化膜27を設けて、穴22方向への赤外線の放射を促進するとともに、その赤外線を隔膜部23側へ反射させる金属材料からなる反射部38を素子基板21の反対面側に設けて、隔膜部23の両面から放射される赤外線を素子基板21の一面側に集中させて、放射パワー密度をさらに高くしている。

【0033】(第3の実施の形態)図6、図7は、本発明の第3の実施形態の赤外線放射素子40を示している。この赤外線放射素子40は、1素子当り複数の隔膜部を設けている。即ち、シリコンの角棒状の素子基板41に複数の穴42<sub>1</sub>~42<sub>N</sub>を一定間隔で一列に設け、この複数Nの穴42<sub>1</sub>~42<sub>N</sub>を素子基板の一面41aに形成された一本の長いp型半導体層43で塞ぎ、このp型半導体層43を複数Nに等分する位置と両端とに金属薄膜45<sub>1</sub>~45<sub>N+1</sub>を形成し、素子基板41の表面を保護と赤外線の放射促進のための酸化膜47によって覆う。

【0034】このように構成することで、一本のp型半導体層43にはN個の隔膜部43<sub>1</sub>~43<sub>N</sub>が縦列に形成され、その隔膜部43<sub>1</sub>~43<sub>N</sub>が金属薄膜45<sub>2</sub>~45<sub>N</sub>によって直列に接続される。

【0035】ここで、例えば、両端の金属薄膜45<sub>1</sub>、45<sub>N+1</sub>をこの素子の第1、第2の電極としその電極間に電圧を印加すれば、各隔膜部43<sub>1</sub>~43<sub>N</sub>に電流が流れ、各隔膜部43<sub>1</sub>~43<sub>N</sub>から赤外線が放射される。

【0036】また、例えばNが偶数の場合には、両端の金属薄膜45<sub>1</sub>、45<sub>N+1</sub>間をパターンあるいは他の配線材で接続し、この金属薄膜45<sub>1</sub>、45<sub>N+1</sub>の一方と、中間の金属薄膜45<sub>N/2+1</sub>との間に電圧を印加して、赤外線を放射させるようにしてもよい。この場合には、隔膜部がN/2個直列に接続されたものを並列に駆動することになる。

【0037】また、図示していないが、複数の隔膜部を

縦横に配列して、直列あるいは並列に接続して、一つの赤外線放射素子を形成することも可能である。

【0038】このように1素子当り複数の隔膜部を設け、その隔膜部を素子上で配線接続した赤外線放射素子は、赤外線の放射パワーを隔膜部の数分増大することができ、例えば各種のヒータの構成素子として用いることができ、しかも、従来と同様の工程で安価に製造できる。

【0039】(第4の実施の形態)図8、図9は、本発明の第4の実施形態の赤外線放射素子50を示している。この赤外線放射素子50では、隔膜部23の表面にn型半導体からなる発熱部54を形成し、この発熱部54の表面両端に第1、第2の電極55、56を形成したものである。

【0040】このように隔膜部23を発熱部54の支持材とする2層構造にした赤外線放射素子50では、構造をさらに堅固にすることができ、しかも、電気的な特性および赤外線の放射特性を隔膜部23の形状とは独立に任意に設定することができる。

【0041】このように隔膜部23の表面にn型半導体からなる発熱部55を設ける場合には、隔膜部23を形成した後に、素子基板の一面に熱酸化処理によって0.5 $\mu$ m程度の厚さで熱酸化膜を形成し、n型半導体を形成する領域の熱酸化膜を写真蝕刻技術によって除去してから、素子基板の一面に対してイオン注入法によって、高濃度、例えばドーズ量として4.0 $\times 10^{16}$ イオン/cm<sup>2</sup>の燐または砒素を加速電圧約125kVで打ち込み、例えば1100°C~1200°Cの高温の窒素ガス雰囲気中で10分から30分程度のアニーリングを施して、前記酸化膜が除去された領域に所望の厚さ(0.5 $\mu$ m~5 $\mu$ m)のn型半導体層を発熱部54として形成する。そして、その表面の熱酸化膜を除去してから第1、第2の電極55、56を形成する。

【0042】なお、隔膜部23の厚さは、例えば隔膜部23の長さが1mm、幅が0.5mm程度の場合には5 $\mu$ mで必要十分な強度となり、隔膜部23の長さが5mm、幅が3mm程度の場合には10 $\mu$ mで必要十分な強度となる。

【0043】また、発熱部54のn型半導体の厚みは、イオン打ち込み量およびアニール温度、アニール時間によって0.5 $\mu$ m~5 $\mu$ mの範囲で任意に設定することができる。例えば、燐のイオン打ち込み量を2 $\times 10^{16}$ イオン/cm<sup>2</sup>、打ち込み電圧を125kV、アニール温度を1180°C、アニール時間を30分とすれば、キャリア濃度4 $\times 10^{20}$ cm<sup>-3</sup>、厚み0.5 $\mu$ mのn型半導体を隔膜部23のp型半導体の表面に形成することができ、その幅を調整することにより、発熱部の抵抗値を任意に設定でき、駆動電流を扱い易い適正な大きさに設定することができる。

【0044】このように隔膜部23上に独立に発熱部5

4を設けた赤外線放射素子50は、チョッピング速度を犠牲にすることなく、従来素子と比べて約50倍近く放射パワー密度を増大させることができた。

【0045】(第5の実施の形態)図10、図11は、本発明の第5の実施形態の赤外線放射素子60を示している。この赤外線放射素子60では、隔膜部63上に発熱部54を設けた2層構造のものにおいて、隔膜部63に第3の電極69を設けている。この隔膜部63に設けた第3の電極69に発熱部54に対して逆バイアスとなる電圧を印加することによって、発熱部54から隔膜部63へ電流の流出を防止することができる。また、第3の電極69に印加する電圧を変換することによって、発熱部54に流れる電流の大きさを制御することもでき、赤外線放射素子の放射パワー密度を可変制御できる。

【0046】(第6、第7の実施の形態)図12～図15は、本発明の第6、第7の実施形態の赤外線放射素子70、80を示している。

【0047】これらの赤外線放射素子70、80では、それぞれの発熱部74、84の中央部74a、84aの幅を広くし、両端部74b、74c、84b、84cの幅を狭く設定して、発熱部74、84の高温部の領域を広くして赤外線放射素子の放射密度をさらに増大させている。

【0048】図16は、前記した第4の実施形態の赤外線放射素子50の放射分布特性Pと上記のように発熱部の中央部の幅を両端部の幅より大となるように設定した赤外線放射素子70、80の放射分布特性Qとを示している。この図16から明らかなように、発熱部の幅を一樣に設定した赤外線放射素子50の放射分布特性Pは発熱部の中心で温度が最大となる単峰特性であるのに対し、赤外線放射素子70、80の放射特性Qは、高温部が広い範囲にわたっている台形特性になっている。

【0049】このような放射特性Qを有する赤外線放射素子70、80では、高温部の面積が広いので、さらに高い放射パワー密度が得られる。

【0050】(第8の実施の形態)図17、図18は、本発明の第8の実施形態の赤外線放射素子90を示している。この赤外線放射素子90は、前記第4の実施形態の赤外線放射素子を縦列に接続した構造を有している。

【0051】即ち、シリコンの角棒状の素子基板91に複数の穴92<sub>1</sub>～92<sub>N</sub>を一定間隔で一列に設け、この複数の穴92<sub>1</sub>～92<sub>N</sub>を素子基板の一面91aに形成された1本の長いp型半導体層93で塞ぎ、その表面に1本の長いn型半導体層94を形成し、このn型半導体層93を複数の穴92<sub>1</sub>～92<sub>N</sub>に等分する位置と両端とに金属薄膜95<sub>1</sub>～95<sub>N+1</sub>を形成し、素子基板91の表面を保護と赤外線放射素子の放射促進のための酸化膜97によって覆う。

【0052】このように構成することで、1本のp型半導体層93にはN個の隔膜部93<sub>1</sub>～93<sub>N</sub>が縦列に形成され、1本のn型半導体層94には、金属薄膜95<sub>2</sub>～95<sub>N</sub>によって直列に接続されたN個の発熱部94<sub>1</sub>

～94<sub>N</sub>が形成されたことになる。

【0053】ここで、例えば、両端の金属薄膜95<sub>1</sub>、95<sub>N+1</sub>をこの素子の第1、第2の電極としその電極間に電圧を印加すれば、各発熱部94<sub>1</sub>～94<sub>N</sub>に電流が流れ、各発熱部94<sub>1</sub>～94<sub>N</sub>から赤外線が放射される。

【0054】また、図示していないが、複数の発熱部を縦横に配列して、直列あるいは並列に接続して、一つの赤外線放射素子を形成することも可能である。

【0055】このように1素子当り複数の発熱部を設け、その発熱部を素子上で配線接続した赤外線放射素子は、赤外線放射素子の放射パワーを発熱部の数分増大することができ、例えば各種のヒータの構成素子として用いることができ、しかも、従来と同様の工程で安価に製造できる。

【0056】また、前記した各実施形態では、素子基板の穴を隔膜部が完全に塞いでいたが、これは本発明を限定するものでない。例えば図19、図20に示す赤外線放射素子100のように、隔膜部23'の中央部23aの幅を穴22の上部幅より小にして(あるいは帯状の隔膜部の幅より穴22の上部幅を大にして)、隔膜部23'の両側において穴22の上部側を開口させてもよい。この場合に、隔膜部23'の中央部23aの両側部から素子基板上に突起23b、23dを延設することによってダイヤフラム構造を補強することができる。このようにした場合、穴22の下部が素子マウント時に閉鎖されても穴22内の熱を逃がすことができ放熱の面で有利となる。なお、この方法は、前記した全ての実施形態について適用できる。

【0057】また、図21、22の赤外線放射素子110のように、素子基板21の下面21bの表面を、例えばニッケルローレンシウム(NiCr)や金(Au)の金属薄膜28で覆うようにすれば、素子をマウントするときにマウント基板との間の接着が容易になる。この素子基板の下面側を金属薄膜28で覆う方法は、前記した全ての実施形態に適用できる。

【0058】なお、図12～図15に示した赤外線放射素子70、80の隔膜部23に第3の電極を設けてもよく、また、図17、図18に示した赤外線放射素子90の各発熱部94<sub>1</sub>～94<sub>N</sub>を赤外線放射素子70、80の発熱部のように構成したり、図17、図18に示した赤外線放射素子90のn型半導体層93に第3の電極を設けてもよい。

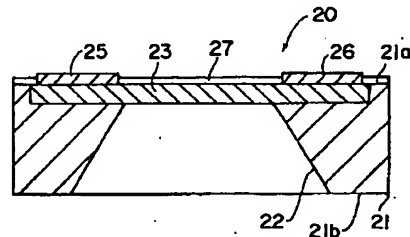
【0059】

【発明の効果】以上説明したように、本発明の請求項1の赤外線放射素子は、いわゆるダイヤフラム構造の隔膜部に電極を設け、隔膜部から赤外線を放射する構造であるので、マイクロブリッジ構造の赤外線放射素子に比べて堅固で、薄い隔膜部でもその面積を大きくすることができ、赤外線放射素子の放射パワー密度を大幅に増大させること

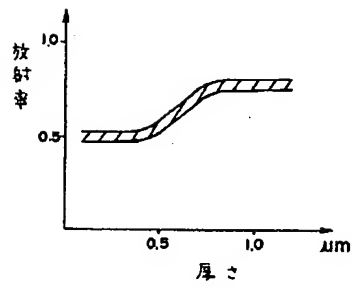
【図1】本発明の第1の実施形態の平面図

69 第3の電極

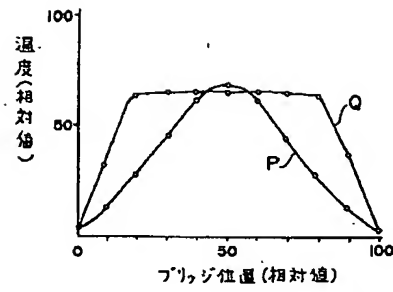
【図2】



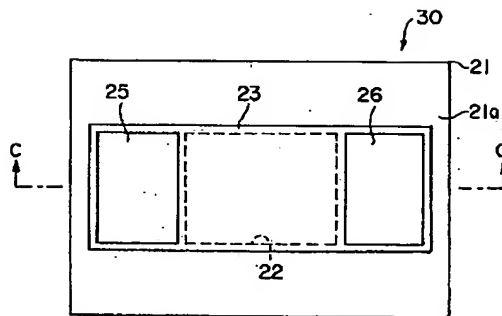
【図3】



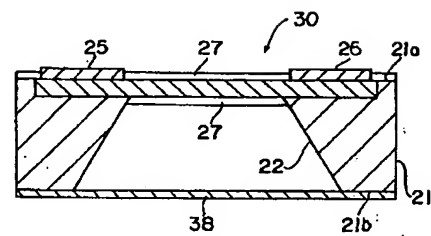
【図16】



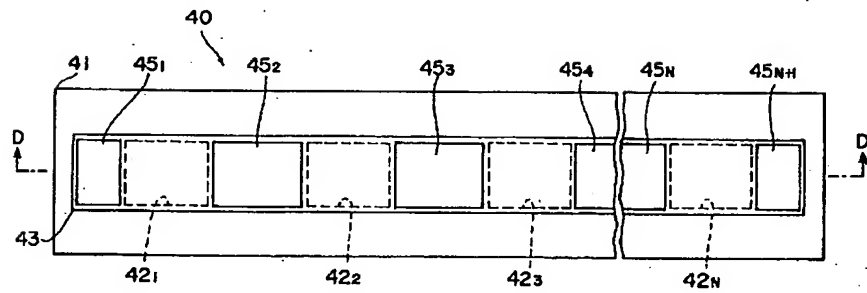
【図4】



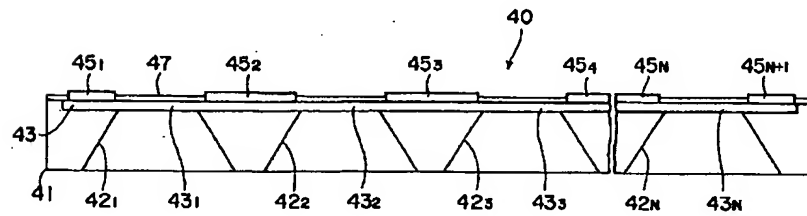
【図5】



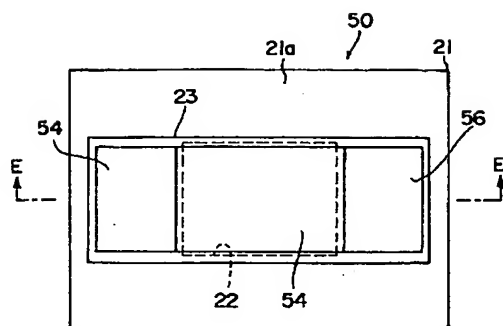
【図6】



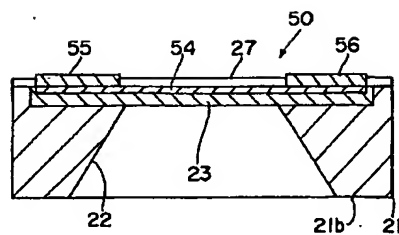
【図7】



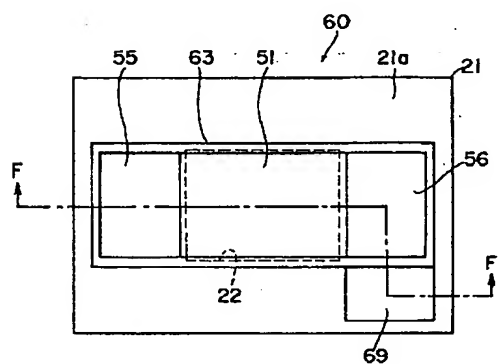
【図8】



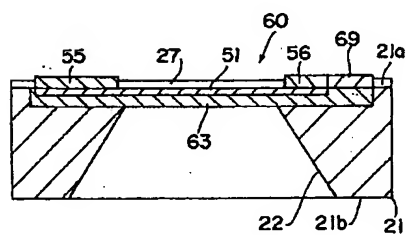
【図9】



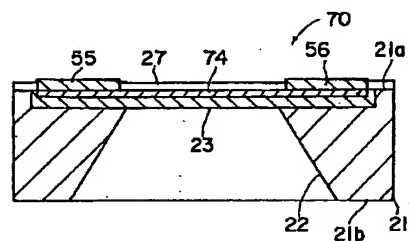
【図10】



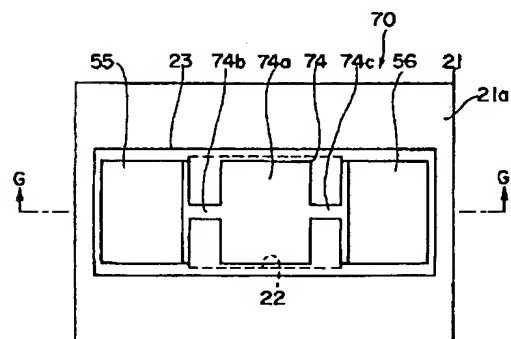
【図11】



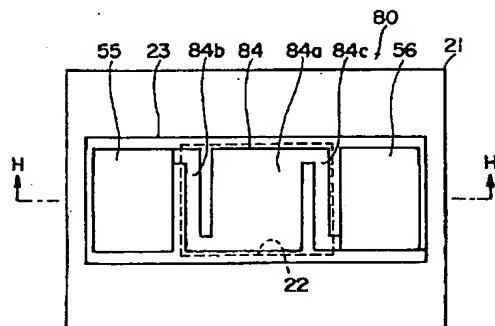
【図13】



【図12】

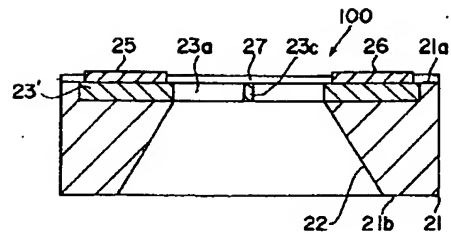


【図14】

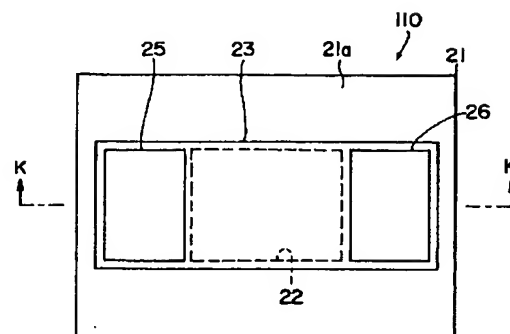




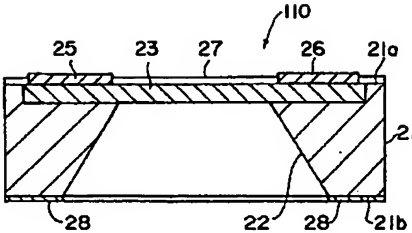
【図20】



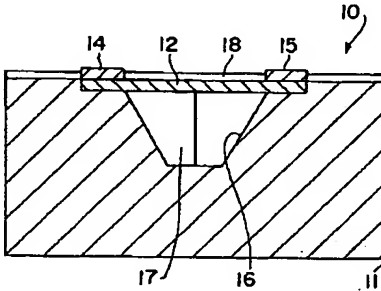
【図21】



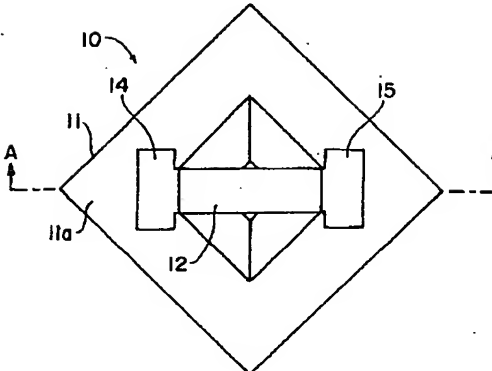
【图22】



【図24】



【图23】



# PATENT ABSTRACTS OF JAPAN

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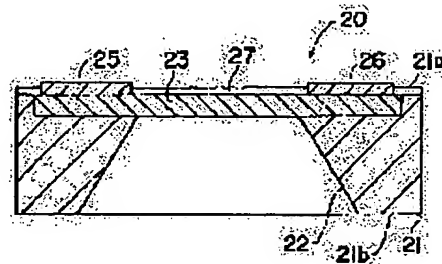
(72)Inventor : KOTADO SETSUO  
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## (54) INFRARED RADIATION ELEMENT

### (57)Abstract:

PROBLEM TO BE SOLVED: To make the mechanical strength compatible with the electric characteristics and radiation characteristics.

SOLUTION: An n-type Si element substrate 21 has a through-hole 22, a strip-like p-type semiconductor diaphragm 23 is formed so as to close one opening face of the hole 22, and first and second metal electrodes 25, 26 are provided on both end faces of the diaphragm 23. When a voltage is applied to the first and second electrodes 25, 26, a current flows in the diaphragm 23 to heat the diaphragm 23 and radiate infrared rays. One surface 21a of the element substrate 21 and surface of the diaphragm 23 are covered with an Si oxide film for accelerating the infrared radiation.



## LEGAL STATUS

[Date of request for examination]

[Date of sending the examiner's decision of rejection]

[Kind of final disposal of application other than the examiner's decision of rejection or application converted registration]

[Date of final disposal for application]

[Patent number]

[Date of registration]

[Number of appeal against examiner's decision of rejection]

[Date of requesting appeal against examiner's decision of rejection]

[Date of extinction of right]

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## CLAIMS

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[Claim(s)]

[Claim 1] The infrared emission component equipped with the membranous part which consists of a p type semiconductor which is formed so that the whole surface side of the component substrate which has the hole penetrated from a whole surface side to an opposite side, and said component substrate may close one effective area of said hole, and emits infrared radiation in response to energization, the 1st and 2nd electrode prepared in the both ends of said membranous part, and the infrared emission promotion film of said membranous part formed so that the whole surface might be covered at least.

[Claim 2] Said infrared emission promotion film is an infrared emission component according to claim 1 characterized by preparing the reflective section which reflects in this membranous part side the infrared radiation which was formed so that both sides of said membranous part might be covered, closed the effective area of another side of said hole to the opposite side side of said component substrate, and was emitted from said membranous part.

[Claim 3] The infrared emission component according to claim 1 or 2 characterized by preparing two or more sets of of said hole and said membranous part in said component substrate, and connecting these two or more membranous parts to it electrically.

[Claim 4] The component substrate which has the hole penetrated from a whole surface side to an opposite side, and the membranous part which consists of a p type semiconductor formed so that the whole surface side of said component substrate might close one effective area of said hole, The infrared emission component equipped with the exoergic section which consists of a n-type semiconductor of said membranous part which is formed in a whole surface side at least, and emits infrared radiation in response to energization, the 1st and 2nd electrode prepared in the both ends of said exoergic section, and the infrared emission promotion film formed so that the front face of said exoergic section might be covered.

[Claim 5] The infrared emission component according to claim 4 characterized by preparing the 3rd electrode in said membranous part.

[Claim 6] Said exoergic section is an infrared emission component according to claim 4 or 5 characterized by being formed so that the width of face of a center

section may serve as size from the width of face of both ends.

[Claim 7] The infrared emission component according to claim 4, 5, or 6 characterized by preparing two or more sets of said hole, membranous part, and exoergic section in said component substrate, and connecting these two or more exoergic sections to it electrically.

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## DETAILED DESCRIPTION

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[Detailed Description of the Invention]

[0001]

[Field of the Invention] This invention relates to the infrared emission component of the diaphragm structure of emitting infrared radiation from the membranous part formed in component substrates, such as silicon.

[0002]

[Description of the Prior Art] The infrared emission component is used also as the light source of the gas-analysis device using the infrared absorption other than the use as a light emitting device.

[0003] Although the filament of the thing, platinum, and the tungsten which embedded the heater to the ceramic was enclosed with the glass tube, since heat capacity is large, when anything of structure has the problem that aging is large, and making infrared radiation emit intermittently (chopping), the high-speed mechanical chopper was required for the infrared light source used from the former for this infrared type gas analysis.

[0004] In order to solve this problem, the so-called infrared emission component of the microbridge structure of preparing the bridge section which uses a micro-machining technique and becomes the whole surface of component substrates, such as silicon, from a semi-conductor, energizing in this bridge section, and emitting infrared radiation is proposed variously.

[0005] As an infrared emission component of this microbridge structure, the thing of the structure shown in drawing 23 and drawing 24 is known.

[0006] With the micro-machining technique, this infrared emission component 10 forms the bridge section 12 which is from a p type semiconductor on the whole surface 11a side of the component substrate 11 of silicon, forms the 1st and 2nd electrode 14 and 15 in the both ends of the bridge section 12, forms a concavity 16 in the center of the whole surface of the component substrate 11, and forms the thermal separation space 17 between component substrates the

inferior-surface-of-tongue side of the bridge section 12. In addition, the part except the front face of electrodes 14 and 15 is covered with the thin film 18 for protection.

[0007] With this infrared emission component 10, if an electrical potential difference is impressed between an electrode 14 and 15, the electrical and electric equipment will flow in the bridge section 12 which consists of a p type semiconductor, the bridge section 12 will generate heat in it, and infrared radiation will be emitted to it.

[0008] Since [ that a component configuration is small ] such an infrared radiating element of microbridge structure has small heat capacity, it has the advantage that high-speed chopping is made.

[0009]

[Problem(s) to be Solved by the Invention] However, in order to make pons beam structure strong, when the width of face and thickness of the bridge section 12 are enlarged with the infrared emission component 10 of the above mentioned microbridge structure, the resistance of the bridge section itself becomes small, a drive current becomes excessive, and there is a problem of usage \*\*\*\*\*.

[0010] Moreover, if the width of face and thickness of the bridge section 12 are made small in order to make a drive current into a proper value, the mechanical reinforcement of the bridge section will fall remarkably and will be destroyed by the fatigue brought about by rapid form status change-ization by turning on and off of external force or a current. Moreover, since the area of the bridge section becomes small, infrared radiant quantities will also fall.

[0011] This invention solves these problems and aims at offering the infrared emission component which reconciled mechanical reinforcement, and an electric property and an electric radiation property.

[0012]

[Means for Solving the Problem] In order to attain said purpose, the infrared emission component of claim 1 of this invention The membranous part which consists of a p type semiconductor which is formed so that the whole surface side of the component substrate which has the hole penetrated from a whole surface side to an opposite side, and said component substrate may close one effective area of said hole, and emits infrared radiation in response to energization, It has the 1st and 2nd electrode prepared in the both ends of said membranous part, and the infrared emission promotion film of said membranous part formed so that the whole surface might be covered at least.

[0013] Moreover, in the infrared emission component of claim 1, as for the infrared emission component of claim 2 of this invention, the reflective section in which said

infrared emission promotion film reflects in this membranous part side the infrared radiation which was formed so that both sides of said membranous part might be covered, closed the effective area of another side of said hole to the opposite side side of said component substrate, and was emitted from said membranous part is prepared.

[0014] Moreover, in the infrared emission component of claim 1 or claim 2, two or more sets of of said hole and said membranous part are prepared in said component substrate, and, as for the infrared emission component of claim 3 of this invention, these two or more membranous parts are electrically connected to it.

[0015] Moreover, the infrared emission component of claim 4 of this invention The component substrate which has the hole penetrated from a whole surface side to an opposite side, and the membranous part which consists of a p type semiconductor formed so that the whole surface side of said component substrate might close one effective area of said hole, It has the exoergic section which consists of a n-type semiconductor of said membranous part which is formed in a whole surface side at least, and emits infrared radiation in response to energization, the 1st and 2nd electrode prepared in the both ends of said exoergic section, and the infrared emission promotion film formed so that the front face of said exoergic section might be covered.

[0016] Moreover, the infrared emission component of claim 5 of this invention has prepared the 3rd electrode in said membranous part in the infrared emission component of claim 4.

[0017] Moreover, said exoergic section is formed so that, as for the infrared emission component of claim 6 of this invention, the width of face of a center section may serve as size from the width of face of both ends in the infrared emission component of claim 4 or claim 5.

[0018] Moreover, in the infrared emission component of claim 4, claim 5, or claim 6, two or more sets of of said hole, membranous part, and exoergic section are prepared in said component substrate, and, as for the infrared emission component of claim 7 of this invention, these two or more exoergic sections are electrically connected to it.

[0019]

[Embodiment of the Invention] Hereafter, the operation gestalt of this invention is explained based on a drawing. In addition, in explanation of each following operation gestalt, the same sign is given to the same component and explanation is omitted.

[0020] (Gestalt of the 1st operation) Drawing 1 and drawing 2 show the infrared

emission component 20 of the 1st operation gestalt of this invention. The component substrate 21 of this infrared emission component 20 is n. - It consists of mold silicon and the hole 22 penetrated from that whole surface 21a side to trapezoidal shape at the opposite side 21b side is formed.

[0021] It is formed in whole surface side of component substrate 21 21a so that the band-like membranous part 23 which consists of a p type semiconductor may close one effective area of a hole 22. If the 1st and 2nd electrode 25 and 26 which consists of metal material is formed in the both-ends front face of a membranous part 23 and an electrical potential difference is impressed to this 1st and 2nd electrode 25 and 26, the electrical and electric equipment will flow to a membranous part 23, a membranous part 23 will generate heat to it, and infrared radiation will be emitted to it.

[0022] Moreover, it is covered with the silicon oxide 27 for promoting radiation of not only the purpose of a surface protection but infrared radiation, and radiation of the infrared radiation from a membranous part 23 is promoted with this film 27 as the whole surface 21a side of the component substrate 21 and the front face of a membranous part 23 are shown in drawing 2.

[0023] Namely, only in the case of the purpose of protection of a component front face, generally about 0.1 micrometers of the thickness of an oxide film are enough, but with the infrared emission component 20 of this operation gestalt, since it became clear that infrared emissivity was markedly alike in carrying out thickness of silicon oxide more than constant value (about 1 micrometer), and it became high as shown in drawing 3 The thickness of the silicon oxide 27 of the front face of a membranous part 23 is set as 0.4 micrometers or more (for example, about 1 micrometer) at least.

[0024] Thus, in the infrared radiating element 20 which prepared the electrode in the so-called membranous part of diaphragm structure, compared with the infrared radiating element of microbridge structure, since the structure itself is strong, a thin membranous part can also enlarge the area and can increase an infrared radiant power consistency sharply. Moreover, since the heat of a membranous part 23 radiates heat moderately through diaphragm structure, a chopping frequency cannot be reduced and it can also become irregular at a high speed.

[0025] This infrared emission component 20 can be easily manufactured with a micro-machining technique. Hereafter, the manufacture approach is explained briefly.

[0026] First, n of field bearing (100) of specific resistance 8 - 15 ohm-cm - A mold single crystal semiconductor is prepared as a component substrate, and a



photo-etching technique removes the thermal oxidation film of the field which forms the thermal oxidation film with a thickness of about 0.7 micrometers, and forms a p type semiconductor layer by performing thermal oxidation processing to the whole surface of the component substrate.

[0027] Next, ion-implantation is used to the whole surface of a component substrate, and they are  $4.0 \times 10^{16}$  ion /  $\text{cm}^2$  as high concentration, for example, a dose. Boron is driven in with the acceleration voltage of 175kV. Annealing for 10 to about 60 minutes is performed in 1100-degree nitrogen-gas-atmosphere mind of the elevated temperature of C-1200-degreeC, and after forming the p type semiconductor layer of desired thickness (for example, 5 micrometers) in the field to which said oxide film was removed as a membranous part 23, the thermal oxidation film of the front face of a component substrate is removed.

[0028] Next, it is the thermal oxidation film (this oxide film) at the thickness of 0.4 micrometers -- about 1 micrometer by thermal oxidation processing to the whole surface of a component substrate. Form and a photo-etching technique removes the thermal oxidation film of the electrode formation field of the both ends of a membranous part 23. protection of a component front face and the object for infrared radiation promotion -- it is -- After forming thin films, such as gold and aluminum, in the whole whole surface of a component substrate with a vacuum deposition method, by patterning, thin films other than an electrode formation field are removed, and the 1st and 2nd electrode 25 and 26 is formed.

[0029] Finally, the hole 22 penetrated from the inferior-surface-of-tongue side of a membranous part 23 to the opposite side side of a component substrate using anisotropic etching properties, such as ammonia liquor, and the carrier concentration dependency of an etch rate is formed.

[0030] Thus, the created infrared radiating element is divided per chip by the dicer, it mounts on packages, such as TO5 mold, and between the 1st and 2nd electrode 25 and 26 of the terminal of a package and an infrared radiating element is wired. In addition, according to an application, the airtight of the inside of a package is carried out to the ambient atmosphere of inert gas in the case of this mounting. Moreover, as for the aperture for the infrared emission of PAKKESHI, glass, sapphire, a calcium fluoride, etc. are used.

[0031] Thus, in the infrared radiator with which the infrared radiating element was mounted in the package, by impressing an electrical potential difference between terminals, the electrical and electric equipment flows in the exoergic section of an internal infrared radiating element, infrared radiation is emitted to it, and this infrared

radiation is outputted to it from an aperture.

[0032] (Gestalt of the 2nd operation) Drawing 4 and drawing 5 show the infrared emission component 30 of the 2nd operation gestalt of this invention. While this infrared emission component 30 forms silicon oxide 27 with a thickness of about 0.4-1.0 micrometers also in the inferior-surface-of-tongue side of a membranous part 23 and promotes radiation of infrared radiation in hole 22 direction. The reflective section 38 which consists of metal material which reflects the infrared radiation in a membranous part 23 side is formed in the opposite side side of the component substrate 21, the infrared radiation emitted from both sides of a membranous part 23 is centralized on the whole surface side of the component substrate 21, and the radiant power consistency is made still higher.

[0033] (Gestalt of the 3rd operation) Drawing 6 and drawing 7 show the infrared emission component 40 of the 3rd operation gestalt of this invention. This infrared emission component 40 has prepared two or more membranous parts per element. 421-42 Ns of namely, holes of plurality [ substrate / 41 / of the shape of a square bar of silicon / component ] It prepares in a single tier at fixed spacing. 421-42 Ns of this hole that is N One long p type semiconductor layer 43 formed in whole surface 41a of a component substrate closes. It is metal thin film 451 -45N+1 to the location and both ends which divide two or more these p type semiconductor layers 43 equally to N. It forms and is a wrap by the oxide film 47 for the promotion of radiation of the front face of the component substrate 41 of protection and infrared radiation.

[0034] Thus, by constituting, they are the membranous parts 431-43N of N individual in one p type semiconductor layer 43. It is formed in a column and is 431-43n of the membranous part. 452-45 Ns of metal thin films It connects with a serial.

[0035] here -- the metal thin film 451 of both ends and 45N+1 if an electrical potential difference is impressed to inter-electrode [ of *Perilla frutescens* (L.) Britton var. *crispa* (Thunb.) Decne. ] as the 1st and 2nd electrode of this component -- 431-43 Ns of each membranous part a current -- flowing -- 431-43 Ns of each membranous part from -- infrared radiation is emitted. [ for example, ]

[0036] Moreover, when the number of N is even, for example, it is the metal thin film 451 of both ends, and 45N+1. Between is connected by the pattern or other wiring material, and it is this metal thin film 451 and 45N+1. One side, and 45Ns of middle metal thin films and 2+1 An electrical potential difference is impressed in between and you may make it make infrared radiation emit to it. In this case, a membranous

part will drive to juxtaposition what was connected to the N/2-piece serial.

[0037] Moreover, although not illustrated, it is also possible to arrange two or more membranous parts in all directions, to connect with a serial or juxtaposition, and to form one infrared emission component.

[0038] Thus, two or more membranous parts can be prepared per element, and the infrared emission component which made wiring connection of the membranous part on the component can increase infrared radiant power several minutes of a membranous part, for example, it can use as a configuration component of various kinds of heaters, and, moreover, can manufacture cheaply at the same process as usual.

[0039] (Gestalt of the 4th operation) Drawing 8 and drawing 9 show the infrared emission component 50 of the 4th operation gestalt of this invention. With this infrared emission component 50, the exoergic section 54 which consists of a n-type semiconductor is formed in the front face of a membranous part 23, and the 1st and 2nd electrode 55 and 56 is formed in the surface both ends of this exoergic section 54.

[0040] Thus, with the infrared emission component 50 which made the membranous part 23 the two-layer structure used as the supporting material of the exoergic section 54, structure can be made still stronger and, moreover, an electric property and an infrared radiation property can be set as arbitration independently of the configuration of a membranous part 23.

[0041] thus, in forming the exoergic section 55 which consists of a n-type semiconductor in the front face of a membranous part 23 After forming a membranous part 23, the thermal oxidation film is formed in the whole surface of a component substrate by the thickness of about 0.5 micrometers by thermal oxidation processing. After a photo-etching technique removes the thermal oxidation film of the field which forms a n-type semiconductor, the whole surface of a component substrate is received. With ion-implantation They are  $4.0 \times 10^{16}$  ion /  $\text{cm}^2$  as high concentration, for example, a dose. Phosphorus or arsenic is driven in with the acceleration voltage of about 125kV. For example, annealing for 10 to about 30 minutes is performed in 1100-degree nitrogen-gas-atmosphere mind of the elevated temperature of C-1200-degreeC, and the n-type-semiconductor layer of desired thickness (0.5 micrometers - 5 micrometers) is formed in the field to which said oxide film was removed as the exoergic section 54. And after removing the thermal oxidation film of the front face, the 1st and 2nd electrode 55 and 56 is formed.

[0042] In addition, the die length of a membranous part 23 serves as reinforcement

with them, and the thickness of a membranous part 23 serves as reinforcement sufficient required by 10 micrometers, when the die length of a membranous part 23 is 5mm and width of face is about 3mm. [ sufficient required by 5 micrometers when 1mm and width of face are about 0.5mm ]

[0043] Moreover, the thickness of the n-type semiconductor of the exoergic section 54 can be set as arbitration in 0.5 micrometers ~ 5 micrometers by the amount of ion implantation and annealing temperature, and annealing time amount. For example, if  $2 \times 10^{16}$  ion /  $\text{cm}^2$ , and a placing electrical potential difference are made to 125kV and 1180-degreeC and annealing time amount are made into 30 minutes for annealing temperature, the amount of ion implantation of phosphorus By being able to form a with - with a carrier concentration of  $4 \times 10^{20} \text{cm}^{-3}$  a thickness [ 3 and thickness of 0.5 micrometers ] n-type semiconductor in the front face of the p type semiconductor of a membranous part 23, and adjusting the width of face, the resistance of the exoergic section can be set as arbitration and it can be set as the proper magnitude which is easy to treat a drive current.

[0044] Thus, the infrared radiating element 50 which formed the exoergic section 54 independently of on a membranous part 23 was able to increase the radiant power consistency by about about 50 times compared with the component conventionally, without sacrificing a chopping rate.

[0045] (Gestalt of the 5th operation) Drawing 10 and drawing 11 show the infrared emission component 60 of the 5th operation gestalt of this invention. With this infrared emission component 60, the 3rd electrode 69 is formed in the membranous part 63 in the thing of two-layer structure which formed the exoergic section 54 on the membranous part 63. By impressing the electrical potential difference which serves as a reverse bias to the exoergic section 54 to the 3rd electrode 69 prepared in this membranous part 63, the outflow of a current can be prevented from the exoergic section 54 to a membranous part 63. Moreover, by carrying out adjustable [ of the electrical potential difference impressed to the 3rd. electrode 69 ], the magnitude of the current which flows in the exoergic section 54 can also be controlled, and the adjustable control of the infrared radiant power consistency can be carried out.

[0046] (The 6th, gestalt of the 7th operation) Drawing 12 - drawing 15 R> 5 show the infrared emission components 70 and 80 of the 6th of this invention, and the 7th operation gestalt.

[0047] With these infrared emission components 70 and 80, width of face of the center sections 74a and 84a of each exoergic section 74 and 84 is made large, the

width of face of both ends 74b, 74c, 84b, and 84c is set up narrowly, the field of the elevated-temperature section of the exoergic sections 74 and 84 is made large, and infrared radiant density is increased further.

[0048] Drawing 16 shows the radiation distribution property Q of the infrared emission components 70 and 80 set up so that it might become the radiation distribution property P of the infrared emission component 50 of the 4th above mentioned operation gestalt from the width of face of both ends with size about the width of face of the center section of the exoergic section as mentioned above. The radiation property Q of the infrared emission components 70 and 80 is the trapezoid property that the elevated-temperature section is migrating to the large range, to the radiation distribution property P of the infrared emission component 50 of having set up the width of face of the exoergic section uniformly being a single peak response from which temperature serves as max at the core of the exoergic section so that clearly from this drawing 16.

[0049] With the infrared emission components 70 and 80 which have such a radiation property Q, since the area of the elevated-temperature section is large, a still higher radiant power consistency is obtained.

[0050] (Gestalt of the 8th operation) Drawing 17 and drawing 18 show the infrared emission component 90 of the 8th operation gestalt of this invention. This infrared emission component 90 has the structure which connected the infrared emission component of said 4th operation gestalt to the column.

[0051] 921-92 Ns of namely, holes of plurality [ substrate / 91 / of the shape of a square bar of silicon / component ] It prepares in a single tier at fixed spacing. 921-92 Ns of this hole that is N One long p type semiconductor layer 93 formed in whole surface 91a of a component substrate closes. It is metal thin film 951 -95N+1 to the location and both ends which form one long n-type-semiconductor layer 94 in that front face, and divide two or more these n-type-semiconductor layers 93 equally to N. It forms and is a wrap by the oxide film 97 for the promotion of radiation of the front face of the component substrate 91 of protection and infrared radiation.

[0052] Thus, by constituting, they are the membranous parts 931-93N of N individual in one p type semiconductor layer 93. It is formed in a column and is 952-95 Ns of metal thin films in one n-type-semiconductor layer 94. 941-94 Ns of exoergic sections of N individual connected to the serial It means that it was formed.

[0053] here — the metal thin film 951 of both ends and 95N+1 if an electrical potential difference is impressed to inter-electrode [ of *Perilla frutescens* (L.)

Britton var. *crispa* (Thunb.) Decne. ] as the 1st and 2nd electrode of this component — 941-94 Ns of each exoergic section a current — flowing — 941-94 Ns of each exoergic section from — infrared radiation is emitted. [ for example, ]

[0054] Moreover, although not illustrated, it is also possible to arrange two or more exoergic sections in all directions, to connect with a serial or juxtaposition, and to form one infrared emission component.

[0055] Thus, two or more exoergic sections can be prepared per element, and the infrared emission component which made wiring connection of the exoergic section on the component can increase infrared radiant power several minutes of the exoergic section, for example, it can use as a configuration component of various kinds of heaters, and, moreover, can manufacture cheaply at the same process as usual.

[0056] Moreover, with each above mentioned operation gestalt, although the membranous part had plugged up the hole of a component substrate completely, this does not limit this invention. for example, like the infrared emission component 100 shown in drawing 19 and drawing 20 , width of face of center-section 23a of membranous part 23' may be made into smallness from the up width of face of a hole 22 (or the width of face of a band-like membranous part — the up width of face of a hole 22 — size — carrying out), and opening of the upper part side of a hole 22 may be carried out in the both sides of membranous part 23'. In this case, diaphragm structure can be reinforced by installing Projections 23b and 23d on a component substrate from the both-sides section of center-section 23a of membranous part 23'. When it does in this way, even if the lower part of a hole 22 is closed at the time of component mounting, the heat in a hole 22 can be missed and it becomes advantageous in respect of heat dissipation. In addition, this approach is applicable about all the above mentioned operation gestalten.

[0057] Moreover, like drawing 21 and the infrared emission component 110 of 22, if the front face of inferior-surface-of-tongue 21b of the component substrate 21 is covered with the metal thin film 28 of nickel lawrencium (Nlr) metallurgy (Au), when mounting a component, adhesion between mounting substrates will become easy. The approach of covering the inferior-surface-of-tongue side of this component substrate with the metal thin film 28 is applicable to all the above mentioned operation gestalten.

[0058] 941-94 Ns of in addition, each exoergic section of the infrared emission component 90 which could prepare the 3rd electrode in the membranous part 23 of the infrared emission components 70 and 80 shown in drawing 12 - drawing 15 , and

was shown in drawing 17 and drawing 18 It may constitute like the exoergic section of the infrared emission components 70 and 80, or the 3rd electrode may be prepared in the n-type-semiconductor layer 93 of the infrared emission component 90 shown in drawing 17 and drawing 18 .

[0059]

[Effect of the Invention] As explained above, since the infrared emission component of claim 1 of this invention is the structure of preparing an electrode in the so-called membranous part of diaphragm structure, and emitting infrared radiation from a membranous part, compared with the infrared emission component of microbridge structure, it can be strong, a thin membranous part can also enlarge the area, and it can increase an infrared radiant power consistency sharply. Moreover, since the heat of a membranous part radiates heat moderately through diaphragm structure, a CHOPPIN frequency cannot be reduced and it can also become irregular at a high speed.

[0060] Moreover, since the infrared emission component of claim 2 of this invention has prepared the reflective section in the opposite side side of a component substrate while preparing the film which promotes radiation of infrared radiation in both sides of a membranous part, it can make the infrared radiation emitted from the membranous part able to emit to the whole surface side of a component substrate intensively, and can make a radiant power consistency still higher.

[0061] Moreover, since a hole and two or more sets of membranous parts were prepared in the component substrate and two or more of the membranous parts are electrically connected to it, the infrared emission component of claim 3 of this invention can make infrared radiation emit by high power from two or more membranous parts, and can be used as various kinds of heaters.

[0062] Moreover, the infrared emission component of claim 4 of this invention Since it is the structure of forming the exoergic section in the front face of the p type semiconductor which forms a membranous part with a n-type semiconductor, considering as two-layer structure, impressing an electrical potential difference to the 1st and 2nd electrode prepared in the both ends of this exoergic section, and emitting infrared radiation It can be made structural still stronger, the exoergic section can be formed independently of the configuration of a membranous part, and the infrared radiation of big power can be emitted with a proper drive current.

[0063] Moreover, with the infrared emission component of claim 5 of this invention, since the 3rd electrode is prepared in the membranous part which supports the exoergic section, the outflow of the current from the exoergic section to a

membranous part can be prevented, and adjustable control of the infrared radiant quantities can be carried out.

[0064] Moreover, with the infrared emission component of claim 6 of this invention, since it forms so that the width of face of the center section of the exoergic section may serve as size from the width of face of both ends, the elevated-temperature field of the exoergic section becomes large, and can make infrared emissivity still higher.

[0065] Moreover, with the infrared emission component of claim 7 of this invention, since a membranous part and two or more sets of exoergic sections were prepared in the whole surface of a component substrate and two or more exoergic sections are connected electrically, infrared radiation can be made to emit by high power, and application is possible for a heater etc.

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#### DESCRIPTION OF DRAWINGS

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[Brief Description of the Drawings]

[Drawing 1] The top view of the 1st operation gestalt of this invention

[Drawing 2] The B-B line sectional view of drawing 1

[Drawing 3] Drawing showing the relation between the thickness of an oxide film, and the rate of infrared emission

[Drawing 4] The top view of the 2nd operation gestalt of this invention

[Drawing 5] The C-C line sectional view of drawing 4

[Drawing 6] The top view of the 3rd operation gestalt of this invention

[Drawing 7] D-D line sectional view of drawing 6

[Drawing 8] The top view of the 4th operation gestalt of this invention

[Drawing 9] The E-E line sectional view of drawing 8

[Drawing 10] The top view of the 5th operation gestalt of this invention

[Drawing 11] The F-F line sectional view of drawing 10

[Drawing 12] The top view of the 6th operation gestalt of this invention

[Drawing 13] The G-G line sectional view of drawing 12

[Drawing 14] The top view of the 7th operation gestalt of this invention

[Drawing 15] The H-H line sectional view of drawing 14

[Drawing 16] The property Fig. showing radiation distribution of an operation gestalt

[Drawing 17] The top view of the 8th operation gestalt of this invention

[Drawing 18] The I-I line sectional view of drawing 17

[Drawing 19] The top view of the 9th operation gestalt of this invention



[Drawing 20] The J-J line sectional view of drawing 19

[Drawing 21] The top view of the 10th operation gestalt of this invention

[Drawing 22] The K-K line sectional view of drawing 21

[Drawing 23] The top view of the conventional component

[Drawing 24] The A-A line sectional view of drawing 23

[Description of Notations]

20, 30, 40, 50, 60, 70, 80, 90 100 110 Infrared emission component

21, 41, 91 Component substrate

22,421-42 Ns, 921-92Ns Hole

23,431-43 Ns, 73, 83,931-93Ns Membranous part

25,451 55,951 The 1st electrode

26, 45N+1, 56, 95N+1 The 2nd electrode

27, 47, 97 Silicon oxide

28 Metal Thin Film

38 Reflective Section

54, 74, 84,941-94Ns Exoergic section

69 3rd Electrode